UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNITED NATIONS CENTRE FOR HUMAN SETTLEMENTS (HABITAT)

SECOND CONSULTATION ON THE BUILDING MATERIALS INDUSTRY

Athens, Greece, 4–8 November 1991

Distr.
LIMITED

ID/WG.510/1
2 May 1991

ORIGINAL: ENGLISH

Issue Paper I*

STRATEGIES AND POLICIES FOR THE DEVELOPMENT OF THE BUILDING MATERIALS INDUSTRY IN DEVELOPING COUNTRIES

Prepared by

the UNIDO Secretariat

* This document has not been edited.

V.91 24008

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I. CONCEPTUAL AND DEFINITIONAL CONSIDERATIONS

1. The building materials industry is generally understood to embrace a wide range of disparate industrial activities for the production of materials that are permanently or temporarily incorporated in construction. The industrial sectors encompassed include agro industry (wood, fibres), metal industry (iron and steel, non-ferrous metals), non-metallic minerals (cement, glass, ceramics, clay products), chemicals (plastics, rubbers, fibres and paints) and engineering (fittings and furnishing). The activities cover primary extraction and processing at one end of the spectrum through manufacturing to fabrication of parts and components at the other. Furthermore, the products originate from a variety of natural resources and intermediate products, the end-uses of which might be equally significant to sectors other than construction. The building materials industry is presumed to exclude activities which are generally considered to form part of the construction industry such as transport to site, cutting, bending, mixing etc. on site to cast the materials to the desired or specified state of finalization. However, the dividing line between the building materials and construction industry is not hard and fast. The trend towards greater industrialization of the construction process through such methods as precasting, prefabricating, modular co-ordination etc. has further blurred the distinction.

2. There are, therefore conceptual and definitional issues that need to be addressed at the outset in order to establish the analytical framework for strategy and policy formulations that are specific to the sub-sector. There are alternative ways of meeting the objective. One approach for grouping building materials for purposes of analyses and policy discussions could be by type of materials used. Such a grouping would include (a) stone, clay, sand and gravel; (b) non-metallic minerals (cement, glass, gypsum); (c) wood-based building materials; (d) metallic building materials; and (e) building materials of chemical origin including new materials.

3. The search for practical solutions to overcome the constraints faced by the building materials sub-sector would be greatly facilitated were the Consultation to address a narrower and more focussed range of products. Consequently, the approach that could go some way to meeting this objective is one that takes into account (a) the preponderance in and criticality of certain products to the construction industry; (b) their potential for reducing construction costs through improvement of productivity and expansion of domestic production; (c) the promotion of increased local content in their production; (d) the prospects of improved and cost-effective use of new and substitute materials; (e) their suitability for production on a small-scale in accordance with prevailing market size, and (f) the applicability and efficiency in alternative construction techniques.

4. In light of the above criteria, the Consultation could usefully centre its deliberations on the manufacture of those building materials which are considered as basic inputs to the construction industry: cement, clay products, wood, iron and steel, sheet glass, and thermoplastics. Consequently, the ensuing analysis is addressed primarily to these materials without, at the same time losing sight of the broader context in which their development takes place including the introduction of new materials through such processes as recycling.

II. DEMAND-SUPPLY GAP

5. The sources of demand for building and construction materials can be taken according to the type of structure, whether housing, public and commercial buildings or infrastructure. The need for housing and other construction is immense in order to accommodate population growth by the year 2000 and beyond. The increasing urbanization in developing countries also puts pressure on the need for more housing and social buildings. As the developing countries industrialize, infrastructure requirements for bridges, roads, dams, and harbours increase at an accelerating rate. Thus the demand for building materials is dependent on the volume of construction activity which in turn is correlated with overall economic performance. In the 1970's the growth of the construction industry in developing countries tended to exceed overall economic growth while in the 1980's many countries, particularly in Latin America, stagnated with resulting declines in the growth rate construction.

6. The cyclical activity of the construction industry helps to explain the fluctuations in demand and the resulting gap in supply. In construction booms the demand increases faster than the domestic building industry can produce the required products. Imports, therefore, are necessary to fill the gap. In recessionary periods, the effective demand for building materials is reduced and the industry has underutilized capacity.

7. In 1985, the share of developing countries in the production of all types of building materials was 16.7 per cent while she share of imports for all types of building material was 30.8 per cent. Exports accounted for only 10.4 per cent for the same year. When taken separately by type of material, the percentages were much higher. Imports of chemical products for instance were the highest, being 53.1 per cent of value of consumption. Regional differences are evident with West Asia being dependent on imports for 46.5 per cent of its finished metal product needs. Tropical Africa had the highest import propensity for both chemical products as well as wood products, 89 per cent and 51.6 percent respectively. There were also large imports of primary as well as finished metal products. As expected, minimally processed mineral products which consist of stone, sand, gravel, etc. had lowest share of imports in both regions at only 1.5 per cent in tropical Africa and 1.9 per cent in West Asia.1/

III. DEMAND SIDE CONSTRAINTS

3.1. Markets

8. The large gap in the developing countries between demand and supply of the basic materials observed in Section II suggests at first sight that the development of the sub-sector is not constrained by the level of aggregate demand. The figures, however, conceal wide disparities in levels and patterns of demand between countries and even within individual countries. There are countries where domestic demand is largely met by domestic supply. However, the large majority of countries are dependent on imports to meet demand, particularly of the main basic materials, namely cement, wood, and iron and steel. On the whole, it is estimated that 40-60% of the consumption of building materials is met by imports.2/

1/ The Building Materials Industry: The sector in figures, Sectoral Studies Series No. 16 Volume II - UNIDO/IS.512/Add.1, 3 October 1985, pp. 15 and 74.

2/ G.A. Edmonds and D.W.J. Miles, Foundation for Change, Intermediate Technology Publication 1984, p.13

9. The small size of markets, their fragmentation and dispersal over wide geographic areas in the majority of developing countries have acted as obstacles to the establishment of manufacturing units which accord with the exigencies of economies of scale. Policies and institutional support measures have generally not been effective in influencing patterns of domestic demand and in consolidating markets through instruments such as regional co-operation. The choice of materials is largely determined by engineers and architects who naturally tend towards the use of state-of-the-arts technology in construction techniques and materials. Consequently, there is a built-in bias against the intensive use of local materials or materials with local content. Skepticism also deters the introduction of new materials particularly of substitute materials which are based on agricultural waste or industrial by-products. Consumer preferences also play a significant role in determining patterns and levels of demand. For example, it is commonly recognized that in some countries wooden housing is not favourably looked upon in spite of its cost-effectiveness. Policies and promotional measures are either deficient or non-existent in many countries with respect to (a) eliminating built-in biases and misconceptions; (b) increasing the local content in the manufacture of building-materials; (c) assessing cost-benefits as a guide for choice of materials particularly substitute materials; (d) consolidating markets to assure economic viability; and (e) giving the right and timely signals to investors for the setting-up of new productive capacities.

3.2. Economies of scale

10. Economies of scale have been one of the determinant factors that has impeded the development in the developing countries of basic materials such as cement and iron and steel as well as other materials such as sheet glass, plywood, fibreboard and particle board and intermediate petrochemical products needed for the manufacture of plastics. Hand-in-hand with policies of market consolidation to increase effective demand, efforts have been directed to the search of technologies which would permit production for small markets. This had led to the notion of "minis" i.e. down-scaling of technologies. In the case of cement, the viability of verticle shaft kilns with installed capacity of as little as 20,000 tons annually has been established through pilot projects.3/ There is still need, however, of continued research to reduce production costs. As in the case of cement, the viability of mini iron and steel plants has been analyzed by a number of UNIDO studies as well as by technical assistance projects.4/ Advances in technology such as cold casting and the reduction process have been instrumental in lowering the level of production concomitant with economic efficiency and resulted in a number of developing countries expanding their own iron and steel industries.5/ The overall conclusion to be drawn from recent successes is that a concerted effort of R&D could offer dividends in terms of reconciling the prevailing dichotomy of market size and notions of economies of scale.

3/ Fred Moavenzadeh, Measures and actions to increase the production of indigenous building materials in the context of enhanced import substitution UNIDO (ID/WG/425/3, 17 August 1984).

4/ S. Samaragpungauan, Integrated development of the steel industry particularly mini steel, linked to capital goods and agricultural machinery UNIDO, ID/WG/458/7, 9 December 1985.

5/ Ibid

11. Considerations of economies of scale are on the other hand less critical for a wide range of secondary building materials, i.e. products derived from basic materials: bricks, clay products, concrete products, timber joinery and structures, fabricated metals, plastics etc. Most are bulk materials and thus costly to transport. Their locations on the whole are predicated by proximity to markets. While the public sector and foreign investors generally predominate the operations of basic materials industries for financial and technological reasons, the secondary building materials industry is eminently suited to small and medium private sector initiatives. Consequently these industries could act as entry points to industrialization and as instruments of decentralization and diversification of the process in the developing countries through the pursuance of policy and promotional measures aimed at entrepreneurial development and optimal utilization of local resources.

12. Furthermore, technological innovations could widen the market for such entrepreneurs. In particular, construction techniques such as prefabrication and modular co-ordination could give rise to profitable ventures in the production of building parts and components in concrete, timber and metals. Ready-made concrete and pre-prepared reinforcing rods are further aspects of a strategic convergence of the building materials and construction industries favouring increased opportunities for small-scale enterprises. Simplication of technologies and equipment could also widen the market for building materials to meet unsatisfied demand particularly in rural areas, e.g. mobile machines for making bricks, cement and soil-cement blocks, culverts and drainage tubes, etc. The discovery and exploitation of hidden opportunities are, however, hampered by lack of information and institutional support to appraise, select and adapt technologies, to assess markets, and to conduct the requisite feasibility studies.

3.3 Production costs

13. Encouraged by buoyant demand, industries were set-up in developing countries under regimes of tariff protection. Examples of countries which achieved international competitiveness through an import-substitution strategy are far less common than those which did not. This is particularly true of iron and steel and sheet glass and less so in the case of cement and wood-based products. One of the main reasons for high production costs is the high capital-output ratios which prevail in developing countries. Costs of capital goods are considerably higher than in industrialized countries. Consequently the high investment costs per unit of output keep production costs elevated. Backward integration aimed at the production of capital goods has generally received scant attention in the majority of the developing countries.

14. Other cost elements are no less critical. The building materials industry is energy-intensive and therefore costs are sensitive to the price of energy inputs as well as to stability of supply as frequent breakdowns add to costs of production. Uncertainties in the supply of raw materials and imported intermediate inputs lead to stoppages and thus costly under-utilization of installed capacities. The mounting debt burden has compounded the difficulties of maintaining capital stock as investments for retooling and rehabilitation have been declining dramatically in recent years. Repair and maintenance systems are inadequate, particularly for the secondary building materials industries. They moreover suffer from a lack of provision of spare parts and common service facilities. Productivity is generally low in the developing countries compared with the industrialized countries. It may be the result of any or a combination of various factors: choice of technology,

labour skills, organization and managerial abilities, stability of input supplies, preventive maintenance, incentives etc. The long-term viability and profitability of the sub-sector is quite clearly critically dependent on productivity improvements.

15. Prices to end-users under conditions of high production costs as outlined above and transportation costs which for bulky materials are also high have significant implications on the achievement of national economic and social objectives. Building materials account for about 40-50% of construction costs 6/. Therefore, the reduction of construction costs is primarily dependent on the productivity and competitiveness of the building materials industry. The rising demand for physical infrastructures, building and social housing would remain unfulfilled in the absence of coherent and co-ordinated efforts directed to raising the productivity of the building materials industry.

IV. SUPPLY SIDE CONSTRAINTS

4.1 Raw material supply

16. There is no dearth of raw material availability in the developing countries as a whole for the production of basic building materials. As a group they are major producers of timber and minerals such as iron ore, bauxite and other non-ferrous ores. They have also built up capacity for primary processing, smelting and refining. Significant thrusts have also been made in the manufacture of semi-finished and finished products. Suitable deposits of clay, limestone, gypsum and sand are also available for the manufacture of bricks, cement, sheet glass etc. There are, however, striking differences in resource endowments among countries. There are surplus and deficit countries in the supply of raw materials which suggests a prima facie case for South-South co-operation in production and trade. Public policy statements in developing countries have long extolled the need of regional co-operation for the optimum and mutually beneficial exploitation of their natural resources but these have yet to be translated into concrete actions. Private sector initiatives could give a much-needed impulse in this respect and the recent steps taken by Latin American countries to promote and implement complementarity projects for the production of semi-finished and finished products in the non-ferrous sector are encouraging. 7/

17. With regard to secondary building materials the issues present themselves in a somewhat different light. These are dependent on the supply of intermediate products of domestic or foreign origin. Prices at which these are supplied determine their long-term viability in the face of competition from substitute or new materials. As firms engaged in these activities do not as a rule generate foreign exchange, market signals might prove inadequate for the allocation of resources. They would need to be backed by public policy measures to assure the predictability of supplies and to promote the optimum use of basic materials locally available and in which the country enjoys comparative advantage.

6/ C.A. Edmonds and D.W.J. Miles, Op. cit, p.13

7/ Max Moya Bedenzo, The development of non ferrous metals in South America and the possibilities for complementarities, UNIDO, ID/WG.481/3 (SPEC) 5 January 1989

4.2. Technology and skills

18. The lack of capacities for the choice, transfer and adaptation of technology is as much a constraint on the development of the building materials industry as it is in other industrial sub-sectors. Advances have been made as noted earlier in down-scaling technologies to enable manufacturing in small-scale plants. Developing countries by-and-large lack the skills and institutional capacities to absorb these advances and adapt them to their own specific requirements and factor of production endowments. Prevailing educational and training programmes often fail to produce the technologists, researchers, managers and operatives which could effectively undertake the challenging task of technological innovation. Consequently, the majority of the developing countries continue to be passive participants in the industrialization process.

19. Technological innovation is a product of collective effort whereby the expertise and experiences of a multi-disciplinary team are made to bear upon the resolution of technological problems on a sustained basis. The mechanisms for pooling these resources are lacking; as are the institutional support measures. They are the critical ingredients of technical progress which technological policy should address to assure the sustainable growth of the building materials industry. Several countries have established building research institutions which have carried out valuable work but the results have, by-and-large, not been translated into investment projects on account of the non-involvement of potential end-users in the research work.

4.3. Entrepreneurship

20. The building materials industry and particularly its secondary materials component provide potential routes of entry for domestic entrepreneurship. The manufacture of materials derived from clay products, cement, metals, wood and plastics for roofing, walling, flooring, etc. gives rise to a variety of small-scale activities. These opportunities, however, are not fully exploited in many developing countries on account of lack of policy and support measures conducive to entrepreneurship development on the one hand and the skepticism or lack of grasp of opportunities on the part of potential investors on the other. The latter might frequently be due to misplaced conceptions of risk as compared to returns on alternative investments usually in the non-productive sectors. The lack of readily available information on markets, technology and sources of financing is a further impediment to the entry of new entrepreneurs. On the other hand, those enterprises which are already established might perceive that the support services that they receive from the public authorities in terms of extension services, common service facilities, access to credits, and allocation of foreign exchange resources are inadequate.

4.4. Finance

21. The magnitude of the current and anticipated shortfalls in the supply of building materials observed in Section II poses a formidable challenge of financing the rehabilitation of installed manufacturing units and the establishment of new ones. The financing of building materials is inextricably linked to the financing of projects of physical and social infrastructures, building and housing. It falls upon Governments to raise the necessary funds for their priority projects from domestic and external sources. Developing countries presently face increasing difficulties in raising external funding on account of their indebtedness problem. External aid and loans which stipulate the importation of building materials would not obviously stimulate the domestic building materials industry. Tied aid is not

in the best interest of the developing countries in that they miss the opportunity of expanding their building materials industry concurrently with meeting their pressing needs for economic and social infrastructures.

22. Financing has been and continues to be a critical constraint on the development of the building materials industry. For that reason, policies should ensure that the industry is enabled to secure the necessary funds to prepare itself to supply the inputs for investments in physical infrastructures and social overheads through (a) ready access to credits; (b) allocating to the building materials sub-sector of a share of the aid and/or loans for construction; and (c) mobilization of domestic resources by means of publicizing of investment.

23. The financing needs of small enterprises present special problems in terms of access to credits and collaterals. These are issues common to all small enterprises, whatever the sector. In regard to building materials, a case for special treatment could be made in the context of well-established programmes for the construction of physical infrastructures and housing. These should make access to credits easier, provided entrepreneurs put forward plausible plans for upgrading or expanding of their operations.

4.5. Institutional support measures

24. The building materials industry is subject to a variety of controls under building by-laws, codes and standards which determine the acceptability of the material to engineers and architects and to the end-user. These could be stringent to an extent as to deter or force entrepreneurs out of business. Developing countries have, by-and-large, adopted the practices of the industrialized countries with minor changes. Designers tend to be more readily influenced by construction practices in industrialized countries rather than of those of the developing countries. Consequently the use of substitute or new materials might be discouraged in favour of materials the characteristics of which are more extensively described in building codes.

25. There is a need for a major reorientation of the services of building research institutions, public housing authorities and municipalities so as to foster a greater receptivity of innovations in established practices and procedures and in encouraging enhanced local content of building materials. There is an evident lack of exchange of information among developing countries in the application of building codes, in the use of research results and in the introduction of new materials and construction techniques to reduce costs of providing housing for low-income groups. The absence in the majority of developing countries of checklists, guidelines and manuals on the characteristics and use of building materials acts as an impediment for new investments as well as reinvestments in existing productive capacities.

V. FINAL CONSIDERATIONS

26. In the light of the constraints outlined above, the Consultation may wish to highlight the key components of strategies and policies that balance the interest of all parties concerned and thus lay a sound foundation for the sustained growth of the building materials industries. To respond effectively to the preoccupations outlined earlier, major changes in policies and institutions may need to be introduced and applied in accordance with the specific needs of individual or groups of developing countries. The formulation and pursuance of national measures would need to take into full account the opportunities offered by international co-operation: regional, South-South and North-South. In the search for solutions that are concrete

and feasible, the Consultation may consider it appropriate to focus its deliberations on the following key aspects of demand and supply that shape strategy and policy formulations.

27. Long-term assessment of demand for all kinds of construction as well as the building materials required needs to be carried out regularly to establish how anticipated shortfalls can be met through domestic production and or imports over time and their implications for the allocation of resources and the formulation of policies. It may be advisable to entrust the task to a central body in Government structures in co-operation with manufacturing and professional associations and the construction sector.

28. Wide fluctuations in construction activities introduce uncertainties in the building materials industry thus denying it a stable market for its products. The predominance of small and fragmented markets also acts as a disincentive for domestic production. Furthermore, there is an unsatisfied demand for building materials caused by various reasons such as high costs of production, regulatory measures that discourage the use of lesser-known substitute materials or new materials, transport costs, energy conservation measures, environmental hazards, etc. Concerted efforts are needed to (a) stabilize the pace and level of construction investments and avoid wide fluctuations which adversely affect the objective of the sustained growth of the building materials sub-sector; (b) promote regional co-operation for widening markets; (c) provide policy guidelines to facilitate the choice and acceptability of competing building measures; (d) adapt building codes to the specific needs of the concerned countries; and (e) institute promotional support measures for locating building materials industries in rural areas.

29. On the supply side, the availability of raw materials determines the possibilities of import-substitution and/or export promotion. The typical situation is that there are resource-surplus countries side-by-side with resource-deficit countries which again opens up opportunities for regional and South-South co-operation. Surveys of raw materials in developing countries would facilitate information on resource availability by country and region. Advances in technology also create opportunities for international co-operation in down-scaling technologies, adapting them to the specific needs of the developing countries and in promoting technological innovations along a broad front. There is also wide scope for co-operation in training manpower at all levels and to develop national capacities for the choice, transfer and development of technology. Related to these are measures aimed at developing entrepreneurship for which the building materials industry is well-suited as a point of entry. With regard to financing, the prospects of the building materials industry is inextricably linked to financing of construction, building and housing. There is a need, however, to separate aid and loan packages from the supply of materials through imports so that these could be utilized for stimulating the domestic building materials industry. Finance is also needed for rehabilitating existing capacities, improving productivity and lowering production costs.

30. There is also a great need for establishing and strengthening institutional support mechanisms through international co-operation and specifically through exchange of information and experiences on technology, markets and research results. The long-term viability of existing and new capacities require measures aimed at (a) reducing investment costs through, inter-alia, domestic manufacturing of capital goods; (b) energy conservation; (c) assured and predictable supplies of raw materials and intermediates;

(d) improvement of managerial and organizational capacities; (e) maintenance and spare parts production; (f) quality control and standardization measures; and (g) close interaction of industry with building research institutes and decision makers. Lastly the role of professionals (architects and engineers) in introducing innovations and in adapting construction techniques to the specific needs and resource endowments of developing countries is crucial to the objective of raising the productivity of the construction industry.

31. In conclusion, while strategy and policy formulations are by their very nature country-specific, there are common concerns and preoccupations in the developing countries which need to be addressed to promote the sustained development of the building materials industry. Some areas of strategy and policy thrusts include:

(i) The integration of the building materials industry with other productive sectors through such means as forward planning of investments in resource-based and related industries and a deliberate policy of encouraging closer inter-action among the main actors in the manufacturing and construction industries; namely planners, policy makers, bankers, manufacturing and professional associations, technologists, researchers etc.

(ii) The stimulation of effective demand by means of lower and affordable prices of building materials through reduction of production costs, introduction of energy-saving techniques and decentralization of the manufacture especially of bulk secondary materials to consumption centres thus saving on transport costs. Clay and cement-based products as well as a range of wood products and plastics are especially suited to a decentralization strategy.

(iii) The promotion of regional co-operation to widen the market for basic building materials, namely cement, iron and steel, non-ferrous metals, sheet glass and plywood and veneers as the strategy could bring about substantive reduction in construction costs through the effective exploitation of economies of scale.

(iv) The encouragement of construction techniques that foster full utilization of the factor endowments of the developing countries, make maximum use of local materials and at the same time permit mass production of parts and components especially aimed at the provision of housing to lower-income groups. Cement, iron and steel, wood and thermoplastics play a crucial role in mass production strategies.

(v) The systematic survey and exploration of natural resources and updating of inventories to sustain the assured supply of raw-materials to the building materials industry and thus stimulate investments in new production facilities and reinvestments in existing ones.

(vi) The intensification of efforts to promote the efficient and effective transfer and development of technology through instruments such as international co-operation in scaling down technologies, setting-up and operating pilot demonstration plants to assess viability and profitability, exchange of information and experiences etc. on the one hand, and on the other to undertake measures aimed at the development of indigenous skills and capabilities to adopt, innovate and improve technologies.

(vii) The purposive search for new or alternate materials aimed at reducing construction costs through increased and intensive use of local materials and/or cheaper sourcing of intermediates such as plastics for walling, roofing, flooring, piping, drainage and joinery. There is wide scope for manufacturing secondary products that can be derived from cement, timber, plastics, agricultural waste and recycling while at the same time safeguarding the environment. There is a need for institutional support measures for cost comparisons and for policy guidance that could stimulate investments. Equally important for cost-reduction strategies is the strengthening of R&D efforts of building research institutions and their effective inter-action with end-users.

(viii) The promotion of production complementarities in the industry. There is a great need to reinforce the linkages between the formal and the informal sectors of production of building materials. Institutional support and guidance will be needed in the identification and selection of the most appropriate materials to be produced in accordance with market needs and on a country-to-country basis.

(ix) The development of private sector indigenous entrepreneurship as the building materials industry and especially the production of secondary materials is well-suited for small- and medium-size manufacturing. Promotional and support measures are, however, essential to assist prospective investors in identifying and evaluating investment opportunities and provide them with a range of extension services to ensure viability and profitability.

(x) The rehabilitation of existing plants to bring about full utilization of installed capacities, raise productivity and reduce production costs. To be effective, however, rehabilitation programmes would need to be conceived and carried out in the context of restructuring objectives and macro-economic adjustments.

(xi) The mobilization of domestic and external financial resources through suitably designed and coherent monetary and fiscal policies and promotional measures to create an environment conducive to investments in the building materials industry. The long-term planning of public investment opportunities could act as a stimulant for mobilizing financial resources. The creation of financial instruments to facilitate easy access to credits constitutes a potent means for increased participation of the private sector in the development of the sub-sector. International co-operation could play a key role in the achievement of this objective involving in particular the domestic and international financial institutions and donor countries.

(xii) The need for quality control in the production of building materials to ensure acceptability in design and durability in use through capacity building in research, testing, standardization and enactment of building codes that are appropriate and responsive to specific local needs are critical components of a strategy of optimum utilization of local building materials and reduction of construction costs. The preparation of manuals, guidelines etc. is one way of fostering common approaches to construction techniques and use of materials.

(xiii) The safeguarding of the environment against degradation of the eco-system arising out of the exploitation of natural resources for building materials such as wood products, plastics etc. is a prerequisite for the orderly development of a sub-sector that is intended, inter-alia, to alleviate social problems and not to aggravate them.

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Athens, Greece, 4–8 November 1991

Distr.
LIMITED

ID/WG.510/2
2 May 1991

ORIGINAL: ENGLISH

Issue Paper II*

MEASURES TO STRENGTHEN THE LOW-COST BUILDING MATERIALS INDUSTRY IN DEVELOPING COUNTRIES

Prepared by

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* This document has not been edited.

V.91-24009

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I. INTRODUCTION

1. The increasing urbanization and industrialization in developing countries, and the global commitment to ensure shelter for all by the year 2000, require an assured supply of a range of building materials that can meet the requirements of different sectors: urban and rural, buildings and civil works, formal and "informal" construction activities, etc. Traditionally, developing countries have met a significant part of this demand through imports. In many developing countries, import of building materials reached a very high level by the late sixties. With the widening gap in balance of payments since the early seventies, national priorities in developing countries have veered towards increased self-reliance in all spheres of the economy. Thus, in the building materials sector, emphasis has shifted to increasing local production and greater utilization of natural resource endowment.

2. Issue Paper I focuses the attention of the Consultation on possible strategies and policies, at national level, that could stimulate the development of the building materials industry in developing countries. While providing a general overview of the characteristics of the building materials industry, it specifically addresses the core building materials industry: production of cement, clay products, wood, iron and steel, sheet glass, and thermoplastics, and examines the demand and supply side constraints that need to be tackled to bridge the current demand-supply gap.

3. The present Issue Paper, highlights the critical and complementary role of the low-cost small-scale building materials industry in ensuring a steady supply of building materials such as alternative binders, blocks and bricks, commercially less accepted species of timber, agricultural and industrial wastes, etc. to the construction industry, particularly the low-cost shelter sector. The paper then proceeds to examine the special structural constraints peculiar to this sector, and finally, draws the attention of the Consultation to the key areas requiring intervention for sustained growth of the low-cost building materials industry.

II. THE SIGNIFICANCE OF LOW-COST BUILDING MATERIALS FOR THE SHELTER SECTOR

4. There is a growing concern among the developing courtries that the persistent shortage of low-cost building materials that are durable but can be afforded by the vast majority of the population, is a serious impediment in improving housing conditions of the people. The problem is particularly acute among the urban low-income groups, which constitute nearly half of the urban population living in inner-city slums and in improvised housing on the fringes of urban areas, who, unlike their rural counterparts, do not have access to traditional non-monetary inputs like clay, stones and vegetal materials from the forests for their building needs.

5. Even in rural areas, the free availability of natural resources such as forestry thinnings, has dwindled over the years with stricter control by governments on forestry resources. However, the area where the rural housing sector is most affected by the shortage of low-cost building materials, is in upgrading the temporary and semi-permanent dwellings which constitute the vast majority of the rural housing stock. This is despite the fact that basic raw materials such as clay, limestone, gypsum, etc. abound in rural areas (even though often in small deposits) and, with little effort, can be exploited for local production of low-cost but durable building materials.

6. The scarcity of low-cost building materials will only intensify with the years, and will frustrate the objectives of the Global Shelter Strategy 1/ and all efforts of the national governments unless concrete and practical steps are taken to drastically improve the availability of affordable building materials to meet the housing needs of the low-income groups.

7. Research and development carried out in recent years have effectively demonstrated that building materials produced entirely from local resources, using simple small-scale production technologies, requiring limited skills that can be found locally, can possess the properties of strength, water resistance and durability required for fully permanent construction. Thus, manually produced burnt-clay bricks, adobe, or stabilised soil blocks, lime-based cements and timber (particularly, locally-available secondary species), if carefully selected, processed and used, can be as satisfactory as factory-made materials such as Portland cement, cement-based blocks, or steel sheet roofing, and can be made available at reduced costs. There are other newly developed materials too, such as rice-husk ash cement, sulphurcrete blocks and fibre-concrete roofing which can provide alternatives without involving costly processing plants, or the import of raw materials or equipment 2/.

8. Despite the foregoing, the local building materials industries in many developing countries have failed to fully commercialise these innovations thus missing tremendous opportunities for indigenisation of the sector, creation of significant additional employment, particularly in local areas, and above all, making available a free supply of low-cost building materials for low-income house-builders.

9. Several factors have inhibited the growth of the low-cost locally-produced building materials sector. The most important among these is the erratic and often low quality of local production that has failed to inspire the confidence of even the less demanding low-income house-builders. Thus, lime and bricks produced in traditional clamp-type kilns or soil blocks, produced by the roadside without proper admixture or compaction, suffer from user prejudices because of their poor and uncertain quality.

10. In addition, the low-cost building materials industry, operating largely in the informal sector, generally suffers from a lack of basic production management capability often operating at a scale that does not permit viable production. Low productivity and wasteful energy consumption also add to the cost of production. All these factors combine to eliminate the natural price advantage of locally-produced materials shifting the user preferences to conventional building materials, often of imported origin or with substantial import content (in raw materials, equipment, energy, etc.) produced by the modern sector.

11. A systematic analysis of the underlying factors that affect the wide-scale production of low-cost locally-produced building materials will be facilitated if these building materials are suitably grouped based on the origin of raw materials, their functional characteristics and production technologies. Such a grouping could lead to the following divisions:

1/ The Global Strategy For Shelter To The Year 2000, UNCHS, HS/185/90/E, 1990

2/ A Compendium of Information on Selected Low-Cost Building Materials, UNCHS, HS/137/88/E.

(a) Small-scale manual production of bricks and tiles;
(b) Use of soils in blocks and rammed-earth construction;
(c) Low-cost binders;
(d) Fibre-concrete roofing;
(e) Application of commercially less-accepted species (CLAS) of timber;
(f) Use of agricultural wastes;
(g) Other innovative low-cost materials.

12. The Consultation may, therefore, like to focus the deliberations specially on the above group of low-cost building materials so that conclusions and recommendations of the Consultation can provide direct and practical guidelines for the promotion of each identified group of materials.

III. CONSTRAINTS IN THE DEVELOPMENT OF THE LOW-COST BUILDING MATERIALS INDUSTRY

13. The problems relating to wide-scale production of low-cost indigenous building materials are many and they often differ from country to country. However, one characteristic that is generally common to most developing countries is the central role that the small-scale and informal sector play in the production of these materials. While the small producers have the advantage of flexibility in operation and in the shifting and volatile markets of the developing countries, by locating plants close to raw material deposits and product markets, and because of their labour-intensive operations, they suffer from several structural constraints, such as their inaccessibility to formal sources of capital or credit, or their inability to acquire vital inputs such as key raw materials, new technology, equipment, energy, etc. The dearth of managerial skills that is common to this sector also contributes to their inability to do forward planning to offset shortages in basic raw materials, or to overcome difficulties in penetrating formal sector markets. Thus, many of the constraints in increasing the production of low-cost building materials are directly related to the operational problems of the small producers.

14. Broadly, the constraints facing the low-cost building materials industry may be categorised as those related to: (a) technology of production; (b) investment requirements; (c) quality of output; (d) demand for indigenous materials; and (e) use of low-cost building materials in construction 3/.

(a) Technology of production

15. Technological inputs needed in low-cost building materials industries may widely differ from country to country and from industry to industry. Thus, some industries may need infusion of new technology (for example, vertical shaft kiln technology for lime production or continuous brick kilns to replace old clamp-type kilns), while others may need to upgrade the existing technology to improve its operational efficiency or to modify the operating process, by, for example, using alternative fuels. In some instances (as in fibre-concrete roofing sheets) slight improvements in the quality of the product may be more important to gain an edge in the market rather than attempts at technological breakthroughs.

16. The first prerequisite in each case is, however, the effective dissemination of technological information to the industry at local level. Experience has shown that the process of dissemination, particularly across

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3/ The Use of Selected Indigenous Building Materials with Potential for Wide Application in Developing Countries, UNCHS, HS/03/05/E, 1985

national borders is often very slow. The channels of communication, even at regional level, are far from adequate. Even though international agencies like UNCHS (Habitat) have published a compendium of information on recent innovations in low-cost building materials technology, local research and development institutions have often been unable to widely disseminate this information to local producers and to demonstrate their viability on an adequate scale 4/.

17. Secondly, few technology suppliers have emerged in developing countries in the field of low-cost building materials. There are some exceptions, however. In India, for example, the Cement Research Institute has developed and licensed rice-husk-ash-cement plant, while the Khadi and Village Industries Commission has been active in establishing lime and lime-pozzolana production units. In the Philippines, the Forest Products Research and Development Institute and the Philippines Coconut Development Authority are actively engaged in research and development for the promotion of coconut wood in low-cost housing 5/. However, most developing countries need to strengthen government policies and institutional support measures in this area.

18. In the limited cases where technologies for production of low-cost building materials have been developed through indigenous efforts, or an innovative technology has been acquired by a national R+D Institution and adapted to suit local needs, the limited absorbtive capacity of small producers has come in the way of commercialization of such innovations. With very little risk-capital at their disposal, they are generally unwilling to venture into market uncertainties. On the other hand, large commercial interests have so far done little to promote new technologies for low-cost building materials. There are a few cases of active support by state industrial development agencies to the small-scale building materials sector, for example, the Small Industries Development Organisation, in Tanzania, which has been supporting small entrepreneurs with credit, infrastructural facilities, skills and entrepreneurial development training, and import of equipment for pilot plants (e.g. to set up vertical shaft lime kilns and for manufacture of sisal fibre-roofing sheets) 6/. It will be useful for other developing countries to emulate such examples.

(b) Investment requirements

19. An important prerequisite for investment in the building materials industry is information on raw materials deposits. Low-cost building materials industries mostly operate on a small-scale and can utilise small-scale deposits of clay, limestone, gypsum, pozzolana, etc. located close to product markets. However, very little information about small-scale deposits is generally available in developing countries. Practically, no information exists about the proven reserves of these deposits or the quality of raw materials. Small-scale entrepreneurs can ill-afford to finance such pre-investment studies and, therefore, need support from the government (e.g., geological survey agencies) to make available such information at nominal

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4/ Ibid.

5/ R.N. Palomar and J.O. Siopongoo. Technology Manual on Coconut Wood as Construction Material, UNDP/UNIDO Regional Network in Asia-Pacific for Low-Cost Building Materials Technologies and Construction Systems.

6/ Case Study on Tanzania - A Strategy for the Development of the Building Materials Sector (UNCHS, unpublished report, March 1990).

cost. Active support from the government in prospecting these deposits will not only help the building materials sector but will also facilitate exploitation of these unutilised natural resources.

20. The viability of small-scale production of indigenous building materials is also affected by the lack of access roads or because of the non-availability of a suitable site for the production plant which ideally should be within an acceptable distance from the source of raw materials. For example, the lime-pozzolana industry in Rwanda exploits limestone deposits from a source five kilometres away from the factory, while the pozzolana is derived from a volcanic ash cone situated about 40 kilometres from the plant 1/. This seriously affects the competitiveness of the alternative binder vis-a-vis Portland cement.

21. The overall capital requirements for the production of most indigenous building materials are relatively low and can generally be met from the domestic resources of developing countries. Materials like lime, bricks, soil blocks etc., can be produced by the small-scale sector with almost all the capital requirements being met from local sources traditionally accessible to small producers. For instance, the investment requirements for production of gypsum mortar can be as low as US$2,500 per thousand tons of annual production as against US$120,000 for the same output of cement mortar 8/. However, there are at least two areas where the capital requirements usually exceed the capacity of small-scale enterprises. The first relates to the need of equipment and machinery that cannot be produced indigenously. For example, a ball mill required to grind pozzolana to the requisite fineness will often have to be imported at a cost which can only be met by many small enterprises with credit support. Yet, in many developing countries, the majority of small enterprises have little access to formal sources of capital or credit, thus forcing them to rely upon the limited savings and borrowing of families and friends. This often acts as a serious constraint to the entry of small-scale entrepreneurs to the low-cost building materials industry.

22. The small-scale sector also generally operates with inadequate working capital which prevents the building up of adequate stock of either raw materials or finished products. A case in point is the use of agricultural residues such as rice husk for production of pozzolanas, or coffee husk as a source of fuel. The seasonal availability of these materials requires building up of adequate stock during harvest time to ensure continued production. Shortage of capital thus forces small producers to operate a sub-optimal levels unresponsive to market demand. This seriously affects their long-term prospects for capacity expansion and healthy growth. Further, it underscores the need for policy measures that would promote credit expansion by state financial institutions, particularly in the rural and small-scale sectors, uninhibited by high administrative costs.

23. The training needs of the low-cost indigenous building materials industries are broadly at artisan, supervisory and managerial levels. Skill requirements at artisan levels can generally be met from the vast reservoir of unskilled and semiskilled labour available in most of the developing countries. Skills upgrading generally takes place in the industry through on-the-job or in-plant training with minimal disruption to the production process. There is now, in fact, considerable evidence that the small-scale

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1/ UNCHS, HS/83/85/E, 1985, op. cit. p. 46
8/ Ibid

and informal sectors, which dominate the low-cost building materials industry, are a veritable training ground for industrial skills providing useful linkages to the modern sector 9/. However, additional training needs exist, particularly concerning special skills in industries acquiring innovative technologies, e.g. in improved brick or lime kilns where process control is rather complex. Usually, acquisition of such skills is an integral part of the technology acquisition process and is generally provided by the supplier or transferer of such technologies. Institutional promotional measures required for this purpose have already been discussed under para 15. Supervisory skills are generally acquired through experience, and on-the-job training, as the artisans graduate over a period of years to supervisory levels.

24. However, the low-cost building materials industries significantly suffer from limited operational efficiency, primarily owing to low levels of managerial and entrepreneurial skills, such as inability to (a) plan ahead; (b) ensure uninterrupted supply of basic inputs; (c) adapt to market variations; and (d)expand the market share for sustained growth. The levels of managerial skills, however, vary from country to country and from region to region. The need is highest in African countries; Asian and Latin American countries have shown rapid development in recent years. This, perhaps, provides the basis for sharing of experience through international co-operation. Ultimately, however, upgrading of managerial skills at the industry level will depend on strengthening institutional measures at national level, and also on increased interaction between the modern and the traditional sectors of the industry.

(c) Quality of output

25. One of the reasons for the poor quality of finished products of low-cost building materials is the lack of attention given to the quality and grade of raw materials used in production. Most low-cost building materials production facilities make use of locally-available deposits for their raw material requirements. Few, however, make a distinction in the variations in quality of such raw materials. On the other hand, for most indigenous cementitious materials, such as lime, gypsum and rice-husk-ash, the quality of the parent raw material is a significant determinant of the quality of the final output. Thus, the finished product is often of poor quality and the customer is dissatisfied. Poor quality also results from inadequate process control, particularly when innovative technology is used.

26. Several factors contribute to this situation. Firstly, in most developing countries, there are few standards for low-cost indigenous building materials. Standards institutions are available in several countries but their priorities often lie outside the indigenous building materials sector. The absence of foreign or international standards for these materials also makes the task of formulation of new standards, particularly for innovative materials, more difficult.

27. Often the availability of a single standard may result in restrictive use of the product. This is particularly true of low-cost alternative binders, which can vary in quality and strength, depending on the grade of parent material and the use of admixtures. Since strength criteria are generally low in low-cost applications, for example, in low-income housing, formulation of

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9/ Small-Scale Building Materials Production in the Context of the Informal Economy, UNCHS, HS/45/84/E, 1984.

graded standards can go a long way in the exploitation of natural resources of the country and in promoting the use of low-cost indigenous building materials. It is noteworthy that China has developed as many as eight different standards for cement, mainly to promote the production of mini-cement plants 10/.

28. Even though standards are the basic framework for promoting quality in production, their enforceability and the user environment are equally important in ultimate quality assurance. The absence of necessary quality-control infrastructure in the low-cost building materials industries (e.g. testing facilities, lack of special skills, etc.) and the general lack of quality consciousness on the part of the small producers (accentuated by the general indifference and less-demanding attitude towards quality of the user market, predominantly of low-income groups), all contribute to the poor quality assurance in the low-cost building materials sector.

(d) Demand for indigenous materials

29. The growth of the low-cost indigenous building materials industry is largely demand-driven, the majority of which originate from low-income house builders. The price of indigenous building materials in relation to other comparable materials (produced by the modern sector) is an important determinant of this demand. Thus, the demand for indigenous cementitious materials largely depends on their market price in relation to the market price of Portland cement. In many developing countries, a major constraint to the wide adoption of these alternative binders has been the failure to command a distinct price advantage on the market. Several factors have contributed to this situation: Portland cement particularly enjoys one or other form of subsidy in most countries. Even locally-produced Portland cement is often subject to price controls or receives freight equalisation subsidies in order to remain competitive with alternative binders.

Other imported basic building materials also usually benefit from import subsidies, exchange rate policies and certain trade policies. Effective government policies which eliminate such distortion in prices will go a long way in promoting the use of indigenous building materials.

30. The inflexibility of existing building regulations, which continue to promote imported building materials, or those produced by the modern sector, is another stumbling block to the increased utilisation of low-cost indigenous building materials. Government-sponsored housing and related construction projects are usually accorded a high status symbol in low-income settlements, but existing building regulations often obstruct the use of low-cost materials in such projects. However, it is encouraging to note that several countries are now adopting separate building regulations for low-income urban settlements 11/. Regional and international co-operation could be particularly useful here to share the experiences of successful country initiatives in this area.

10/ R.J.S. Spence. Appropriate Technologies for Small-Scale Production of Cement and Cementitious Materials. Monograph No. 12 on Appropriate Industrial Technology, UNIDO, 1980.

11/ The Reformulation of Building Acts, Regulations and Codes in African Countries, UNCHS, HS/81/85/E, 1985.

(e) Use of low-cost materials in construction

31. The absence of requisite artisan skills in the construction sector for appropriate use of indigenous building materials is often a major obstacle, particularly in introducing innovative materials to the market. An indigenous building material can be sold at a low price on the market; nevertheless, where construction skills are deficient, the overall objective of low-cost construction is defeated - either because of the excessive use of materials in construction or through inappropriate application. In most cases, skills in using indigenous materials in construction are taken for granted overlooking the fact that some indigenous building materials are relatively new to local craftsmen who need special training or orientation for proper application of these materials. Thus, in many instances, innovative materials remain unpopular and do not find wide adoption due to artisan prejudices born of ignorance or non-familiarity. Formulation of codes of practice and specifications for use of low-cost materials in construction could remedy the situation to a great extent.

IV. FINAL CONSIDERATIONS

32. A critical analysis of the constraints that currently inhibit the growth of the low-cost indigenous building materials industry in developing countries, as briefly outlined in the foregoing text, will provide the essential framework for the formulation of a set of practical measures at industry, sub-national, national, regional and international levels that could accelerate its balanced growth by fully harnessing the indigenous factors of production. In its deliberations, the Consultation may follow a structured approach, concentrating, in turn, on the following key areas of intervention, which, taken together, would provide a comprehensive set of measures and actions to realize the objectives of this exercise.

33. The first of these relates to Government policy measures that are necessary and constitute a prerequisite for the revitalisation of the low-cost indigenous building materials industry. Since the industry is inextricably interwined with the small-scale sector and the informal sector of the productive economy, intervention will be required in wide-ranging areas of public policy, particularly in domains of fiscal policy (e.g. tariff protection to fledgling industries), investment policy (tax concessions and other incentives to small-scale and informal sector operations), technology policy (increasing emphasis on labour-intensive technologies, optimum exploitation of the natural resource endowment of each country, etc.), and manpower development policy (upgrading the skills and entrepreneurial capacity of the traditional and informal sectors, and facilitating mobility between these and the modern sector).

34. Secondly, in the area of institutional support measures, the widely varying capacities at country level provide considerable scope for regional and South-South co-operation, apart from national initiatives. Gearing up local capacities for prospecting of small-scale deposits of raw materials will be vital. Development of special skills, particularly for innovative technologies, both at production and application levels, will also be important. However, perhaps the most crucial area of institutional support would be to extend and expand credit facilities to small-scale producers. Redirection of R+D efforts through suitable institutional reforms and improvement of flow of information from research and development institutions to the industry will be other important areas for consideration.

35. Thirdly, effective promotional measures will be equally crucial for the development of the low-cost building materials sector and will need a well co-ordinated domestic effort and international co-operation. Important promotional measures would include formulation and documentation of appropriate standards and specifications for the production and utilisation of low-cost indigenous building materials, reformulation of building regulations to bring them in line with the needs and price range of the low-income groups, and stimulation of demand by organisation of demonstration projects to popularise these materials.

36. Finally, in its deliberations the Consultation may like to keep in view, among others, the following thrust areas for national action and international co-operation:

(i) Reinforcement of the linkages between the low-cost building materials sector and the modern sector (covered by Issue I) for a holistic and complementary growth of the building materials industry, through intra-industry sharing of technology and skills, and optimal and sustainable exploitation of national resources, with the ultimate aim of accelerating the economic and social advancement of developing countries;

(ii) Strengthening of the small-scale industries in the low-cost building materials sector through well co-ordinated and coherent policies, institutional support, and promotional measures to facilitate the progressive transition of these industries into the modern sector;

(iii) Promotion of the redirection of research efforts in national R+D institutions towards development of innovative technologies for production of low-cost indigenous building materials and also for the elimination of current technological constraints, particularly with regard to improving quality and reducing costs in small-scale enterprises;

(iv) Intensifying efforts to transfer appropriate technologies to the low-cost indigenous building materials industries through international co-operation; similarities of factor proportions in production, and common constraints faced by the developing countries, make regional and South-South co-operation advantageous in this field;

(v) Provision of industrial extension services to small-scale entrepreneurs to facilitate setting up new ventures or expanding existing capacities. Such services should include:

(a) preparation of techno-economic feasibility studies which could help entrepreneurs to secure long-term and short-term capital from financial institutions;

(b) advice to entrepreneurs on choice of technology, selection and procurement of equipment;

(c) provision of information to entrepreneurs on location of raw material deposits, exploitable reserves and their quality;

(d) assistance to entrepreneurs in improvement of management capabilities, particularly in areas relating to marketing, financial accounting, cost accounting, factory legislation, personnel relations, etc.;

Availability of such consultancy services for resolving operational problems of small enterprises is an important element in improving the efficiency and productivity of the low-cost indigenous building materials industries;

(vi) Promotion of the development of industrial co-operatives in the low-cost building materials sector as a means of strengthening the informal sector operations through necessary policy, institutional and promotional support measures. The co-operatives can bring economy of scale in production and improve the bargaining power of the small producers, both in respect of access to basic inputs as well as in marketing operations;

(vii) Promotion of standards and specifications and other regulatory measures for greater utilisation of low-cost indigenous building materials in the construction industry, particularly in low-income housing and government-sponsored projects;

(viii) Promotion of dissemination of information among prospective users, particularly low-income groups, on available low-cost alternatives to conventional building materials, through carefully conceived demonstration projects jointly executed with selected producers of low-cost materials;

(ix) Promotion of clean and energy-efficient technologies, and sustainable, environmentally-sound utilisation of natural resources in the low-cost building materials industry. The exploitation of natural resources in an indiscriminate and disorderly manner, often present in informal sector operations, affects the very sustainability of such actions and proves counter-productive in the long run. Effective disincentives to such operations are needed to be built into the existing policy and institutional framework.